



Independent Statistics & Analysis

U.S. Energy Information
Administration

May 25, 2021

MEMORANDUM FOR: Angelina LaRose
Assistant Administrator for Energy Analysis

FROM: Jim Diefenderfer
Director, Office of Long-Term Energy Modeling

SUBJECT: Summary of AEO2022 Buildings Working Group held on
May 25, 2021

This memorandum summarizes the presentation we gave at the first *Annual Energy Outlook 2022* (AEO2022) Buildings Working Group meeting and the discussion that followed. The presentation first recapped the AEO2021 results and then highlighted the major modeling and data updates planned for AEO2022. The [presentation](#) for this meeting is available in a separate document.

Debrief of AEO2021 results

We began the meeting with a reminder of how we incorporated COVID-19 pandemic effects into AEO2021, and then we gave a high-level overview and debrief of AEO2021 results. We reiterated how the residential and commercial characterization of end-use electricity consumption and onsite distributed generation for own use at the building site changed for AEO2021. We also described a recent update that enables our models to account for commercial sensors and controls, updated commercial building codes, and revised residential housing decay (or demolition) rates. In addition, AEO2021 incorporated solar photovoltaic cost estimates based on the National Renewable Energy Laboratory's latest *Annual Technology Baseline*. Finally, we discussed the updated representation of LED lighting costs based on recent bulb costs and the elimination of the 2020 backstop lighting standard, as previously set by the Energy Independence and Security Act 2007 (EISA2007).

We then presented AEO2021 Reference case data for residential and commercial sector energy consumption. In the residential sector, we project electricity consumption to grow while natural gas and petroleum consumption decrease. In the commercial sector, electricity consumption grows faster than natural gas consumption. Overall, buildings consumption of natural gas, petroleum liquids, and other fuels decreases from 2020 to 2050. In contrast, AEO2020 projected that commercial sector electricity

and natural gas consumption would increase through 2050, whereas petroleum liquids and other fuels would remain flat.

AEO2022 model updates, policy updates, and historical updates

We discussed various planned updates for AEO2022. We highlighted a new contractor report that updates and adds new characterizations for [residential and commercial miscellaneous electric loads \(MELs\)](#). This new information continues work from past MELs reports created for EIA and the U.S. Department of Energy. We showed how end-use consumption is calculated in the report—including an example of how television consumption projections have changed between the previous report and current report—and pointed out the end uses that we will model for the first time this coming cycle.

Building on our analysis for AEO2021, we will endogenously calculate housing decay rates that we had analyzed exogenously for the previous report. This change will allow interactions that are more dynamic across our side cases, where macroeconomic activity varies.

We discussed how we are incorporating data from Lawrence Berkeley National Laboratory's latest *Distributed Solar Data Update* (formerly *Tracking the Sun*).

We discussed how we will address new federal rulemakings that may be enacted before the end of our modeling season. For example, we will consider any new federal energy efficiency standards or ENERGY STAR specifications, such as new specifications announced for air-source heat pumps and heat pump water heaters. AEO2022 will also include revised federal energy efficiency rebates and renewables tax credits extended by the Consolidated Appropriations Act, 2021, that passed late in 2020.

We highlighted several notable historical updates that we complete for each AEO, for example:

- Updating sectoral energy consumption by fuel
- Refining historical and projected impacts of utility energy efficiency incentives
- Incorporating new weather data (and forecasts) from the National Oceanic and Atmospheric Administration (NOAA)
- Calibrating residential space heating equipment shares and average residential square footage to U.S. Census Bureau data

Other items

In the medium and long term, we are planning to:

- Update the characterization of residential and commercial lighting, commercial refrigeration, and commercial ventilation technologies
- Model thermal and battery storage technologies in buildings
- Identify ways we can use the residential and commercial models to analyze buildings-related electrification.

We reminded attendees about our online AEO data table browser and API tools. Several attendees commented that they use those tools regularly and appreciate easy access to our data.

We highlighted a list of buildings-related reports, including recently updated reports on [modeling distributed generation in the buildings sector](#) and [price elasticities for energy use in buildings](#). We also shared a recent *Today in Energy* article that profiled forecasts of residential, commercial, and industrial electricity sales in the *Summer 2021 Electricity Industry Outlook*, a supplement to the *Short-Term Energy Outlook*.

Finally, we mentioned that we are hiring new employees and indicated that further information is available on our careers web page.

Discussion

A participant asked whether we use NREL's Distributed Generation Market Demand model (dGen) to project distributed generation. We explained that we do not use dGen to develop AEO projections, but we are aware of model developments. We provided a link to a recently completed [report that clarifies key differences](#) between EIA's residential and commercial modeling systems.

A participant asked about how upcoming model updates address growing consumption among home electronics and commercial data center equipment. We explained what technologies we will include in the AEO2022 MELs update and shared a link to the recently published [MELs report](#) that includes information about the presence of equipment in residential and commercial buildings and projected penetration across the U.S. building stock over time. We also clarified that the report disaggregates specific MELs at a finer resolution than before to capture differences in the way people use and charge tablets as compared to smart phones, for example.

To address a question about calculating net building energy consumption, we explained how changes to distributed generation reporting make it easier to compare distributed generation for use at the building site and purchased electricity projections in each sector to total electricity consumption projections.

In response to a question about whether the MELs update would affect load shapes, we clarified that the buildings models are annual models, and therefore, we do not incorporate assumptions about load shapes into our electricity consumption projections.

A participant asked for more detail on our residential building code assumptions. We explained that we model consumer adoption of different combinations of building shell and space heating and cooling equipment, each of which meets various building codes and ENERGY STAR specifications.

We clarified that we do not pass the utility bill savings attributed to energy efficiency programs back to the macro module or otherwise reincorporate them into baseline GDP assumptions. However, the presence of and participation in energy efficiency programs can reduce demand for fuels, which in turn affects fuel prices.

A participant asked whether we incorporate updated standards, such as updates to minimum seasonal energy efficiency ratios (SEER). We clarified that the SEER2 standards that have been released and that will go into effect in 2023 are already incorporated into NEMS. We also followed up after the meeting to further discuss incorporating SEER2 standards into our projections.

A participant asked about whether our projections account for electric vehicle (EV) charging loads in the building sector and whether we publish data about the number of buildings with EV charging equipment. We referred the participant to the Transportation Energy Efficiency and Consumption Analysis group, which models vehicle electricity consumption in the transportation sector. We also explained that technology shares are based on *Commercial Buildings Energy Consumption Survey* and *Residential Energy Consumption Survey* results and that future publications may contain this information.

We described the eight core side cases that we will release as part of the AEO2022 and explained that we have not determined which additional side cases we will develop. A participant asked whether we will model a scenario exploring decarbonization. We explained that we are currently in the process of evaluating the resources we would require to develop a deep decarbonization scenario.

A participant asked for more information about NOAA population-weighted weather data to be released this fall. We followed up after the meeting and provided NOAA contact information to the participant by email. Another participant asked how changing weather normals relate to assumptions about climate change. We clarified that the changing weather normals would only affect our projections to the extent they are included in NOAA's 15-month forecast. Beyond the 15-month forecast, we use a trend based on the past 30 years of actual historical data to develop state-level projections for population-weighted heating and cooling degree days, which are then aggregated to the census division level.

After the event, a participant asked whether we are considering shifting to a whole-building, integrated approach to modeling energy consumption. We explained how the Residential Demand Module models consumer choice among various combinations of building shell and space heating and cooling technologies. We described other iterative steps we have taken in this direction but explained that we will not substantially alter our approach to modeling energy consumption and efficiency for buildings in the near term.

Attendees

Name	Affiliation
John Agan	U.S. Department of Energy
Justin Baca	Solar Energy Industries Association
Marilyn Brown	Georgia Tech
Matthew Cleaver	Leidos, Inc.
Michael Freels	Oregon Department of Energy
Adam Guzzo	U.S. Department of Energy
Chioke Harris	National Renewable Energy Laboratory
Andrew Held	DC Department of Energy and Environment
Bob Hershey	Robert L. Hershey, P.E.
Ian Hoffman	Lawrence Berkeley National Laboratory
Andrew King	California Air Resources Board
Stephanie Kruse	Oregon Department of Energy
Jared Langevin	Lawrence Berkeley National Laboratory
Eric Mackres	World Resources Institute
Cara Marcy	U.S. Environmental Protection Agency
Jack Mayernik	National Renewable Energy Laboratory
Glen Salas	Simonson Management Services
Aven Satre-Meloy	Lawrence Berkeley National Laboratory
Derek Schroeder	U.S. Department of Energy
Rodney Sobin	National Association of State Energy Officials
Andy Winslow	Northeast Energy Efficiency Partnerships
Frances Wood	OnLocation, Inc.

EIA staff attendees

Tuncay Alparslan	Ruey-Pyng Lu
Stacy Angel	Laura Martin
Erin Boedecker	William McNary
Francisco Cifuentes Villarroel	Joelle Michaels
Jim Diefenderfer	Kyle Morley
Kevin Jarzomski	Kevin Nakolan
Ari Kahan	April Patel
Mala Kline	Kelly Perl
Angelina LaRose	Andri Rizhakov
Greg Lawson	Nicholas Skarzynski
Mary Lewis	Manussawee Sukunta
Perry Lindstrom	Courtney Sourmehi